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ABSTRACT:

A coupler for connecting a dipper arm of an excavator to a bucket without the need for the operator of the excavator to leave the cab of the excavator, the coupler having means for connecting it to the end of the dipper arm, and means, including a latching hook for connecting it to one of a plurality of different buckets and wherein locking means is provided to prevent inadvertent unlatching of the latching hook, said locking means being operable from the cab. The locking means may be gravity operated and include resiliently deformable means thereon to prevent unlatching when the coupler is inverted. Alternatively, it may be spring operated in which case, further means is provided to move the locking means against the bias of the spring. Preferably, the hook has a special internal profile so that when it is supporting the weight of a bucket, it will tend to move to a latching position, not to an unlatching position

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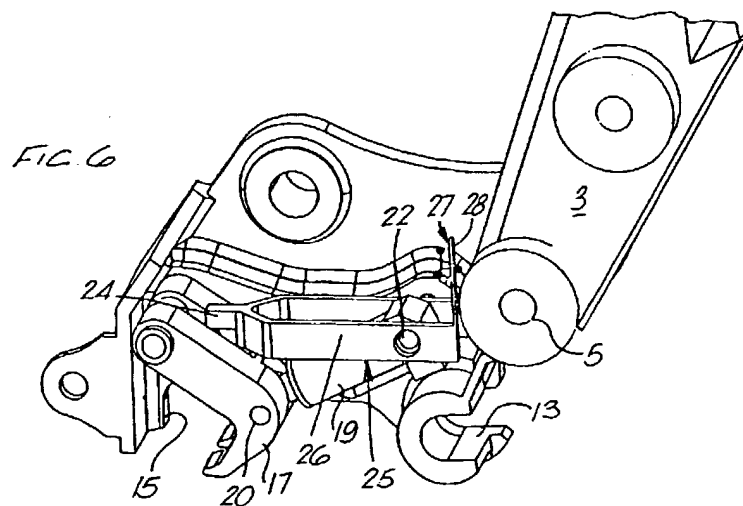
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(54) Abstract Title

Quick coupler for bucket excavators

(57) A coupler for connecting a dipper arm 3 of an excavator to a bucket without the need for the operator of the excavator to leave the cab of the excavator, the coupler having means for connecting it to the end of the dipper arm, and means, including a latching hook 17 for connecting it to one of a plurality of different buckets and wherein locking means 25 is provided to prevent inadvertent unlatching of the latching hook, said locking means being operable from the cab. The locking means may be gravity operated as shown and include resiliently deformable means 27 thereon to prevent unlatching when the coupler is inverted. Alternatively, it may be spring operated (71, Fig 13) in which case, further means (73 or 75) is provided to move the locking means against the bias of the spring.

The further means may be a cord and pulley (73) or hydraulic cylinder (75). The hook 17 may have one or more steps (41, Fig 8) to engage with a locking bar. Preferably the lock is released by gravity, as the bracket reaches full curl position. Preferably the latch is hydraulically actuated 19. Preferably, the hook has a special internal profile so that when it is supporting the weight of a bucket, it will tend to move to a latching position, not to an unlatching position.



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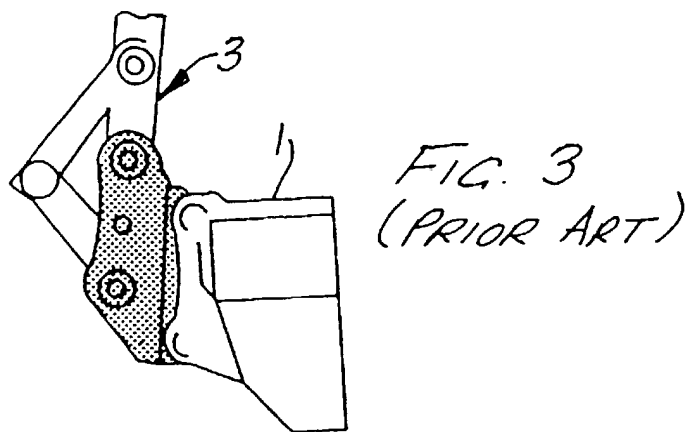
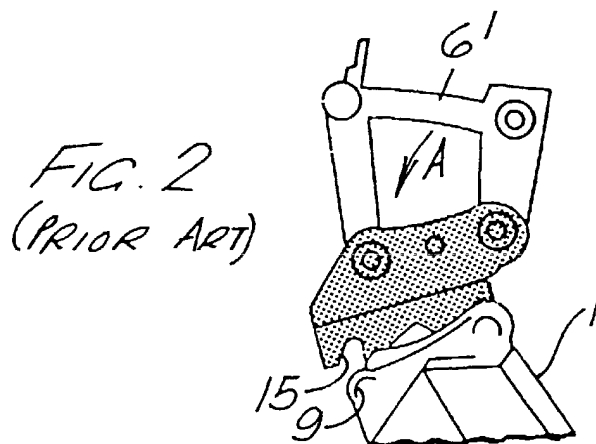
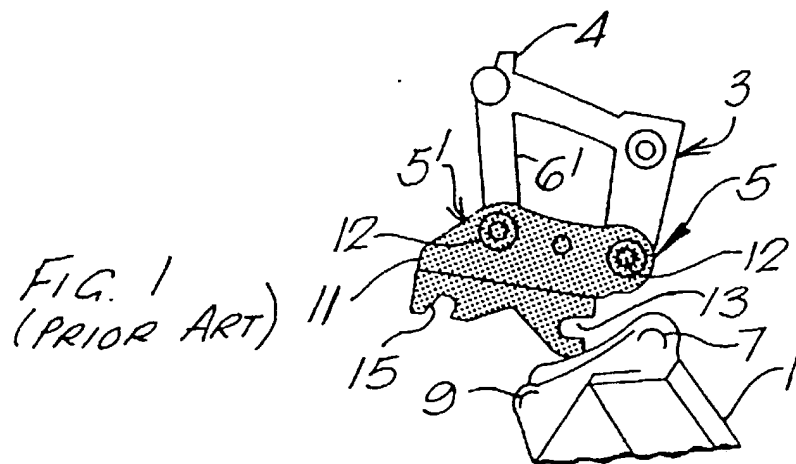
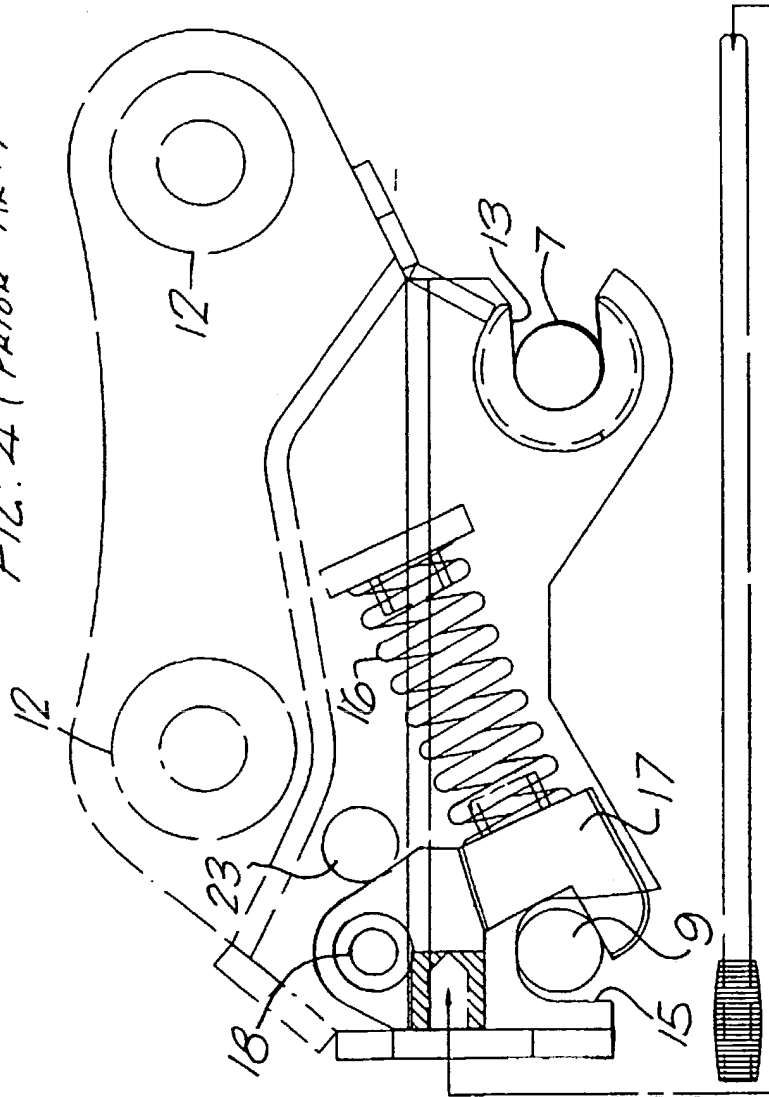
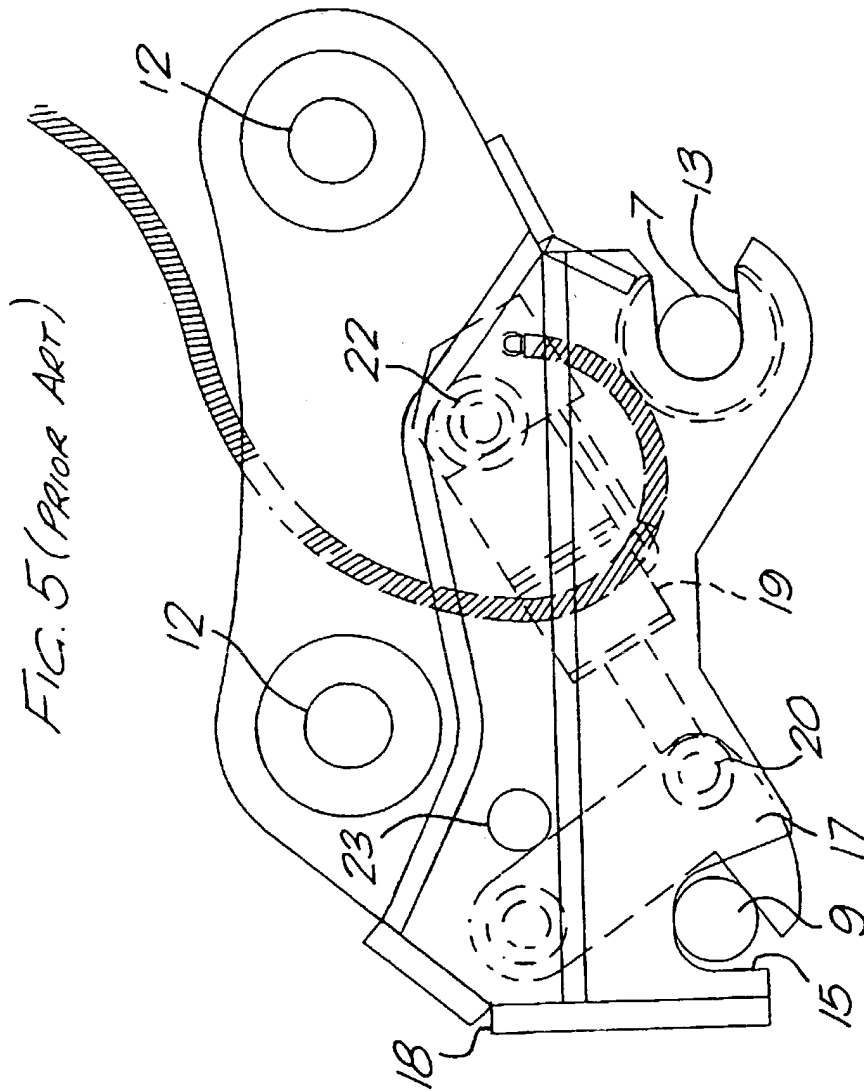


FIG. 4 (Prior Art)



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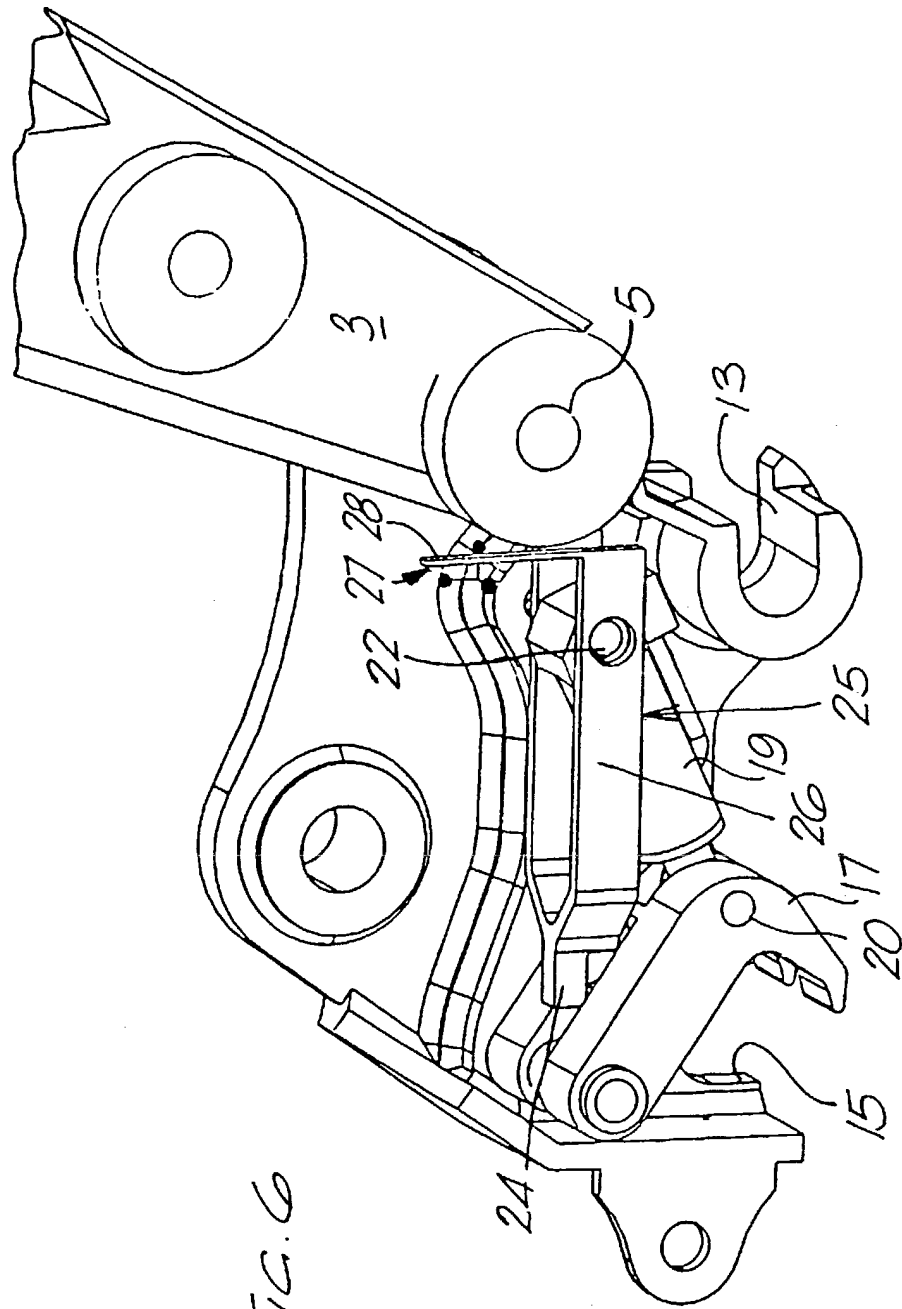


FIG. 6

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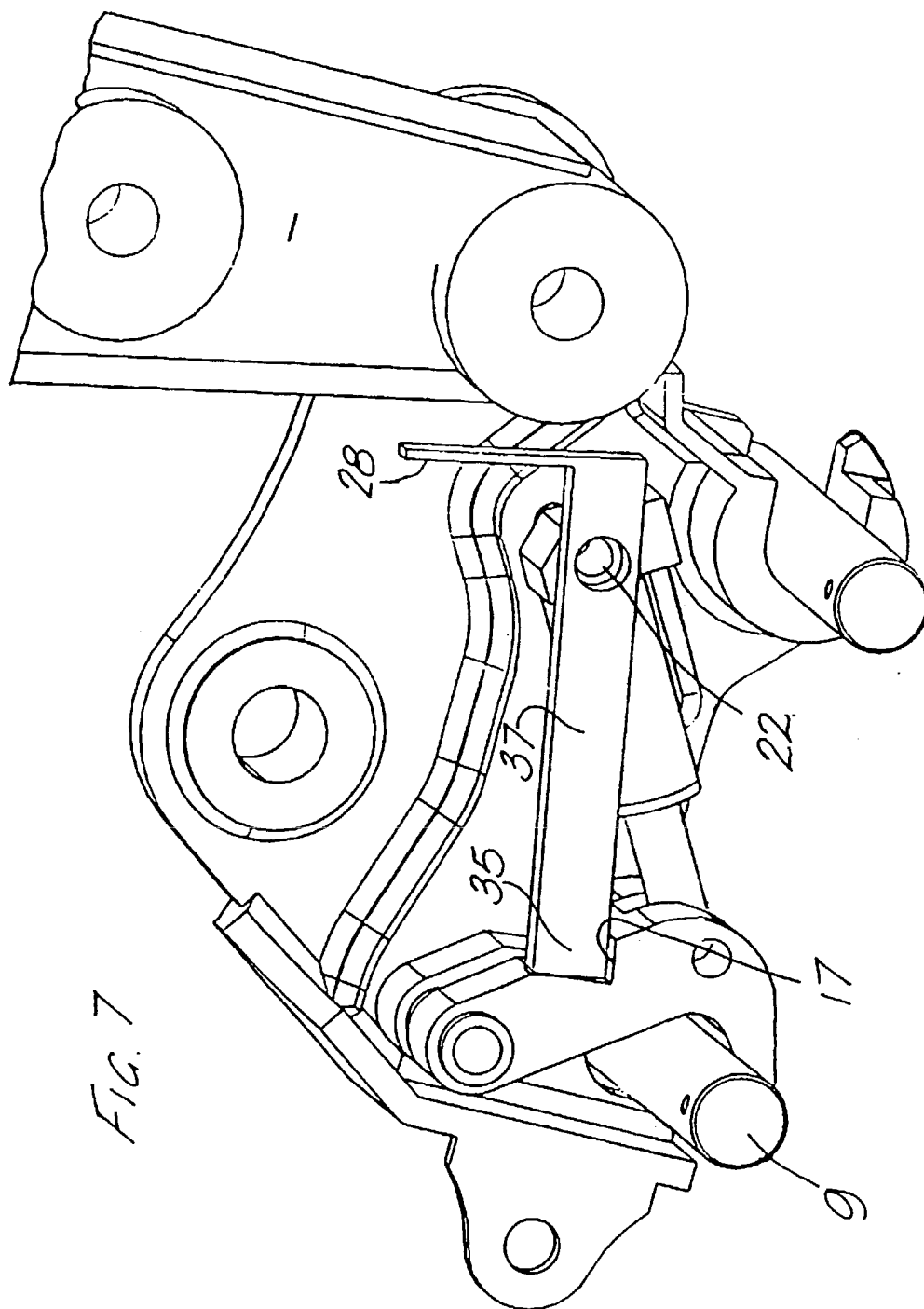


FIG. 7

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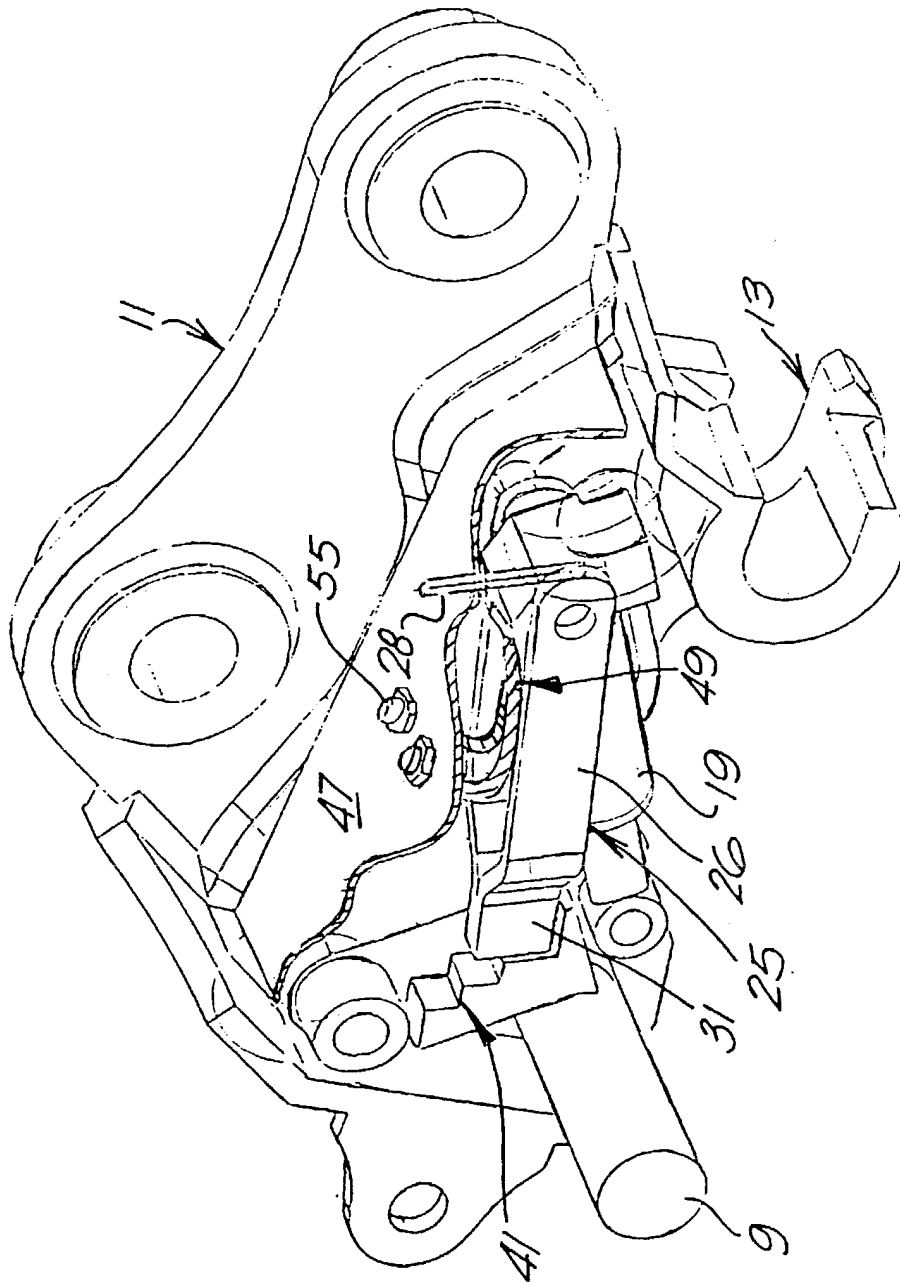


FIG. 8

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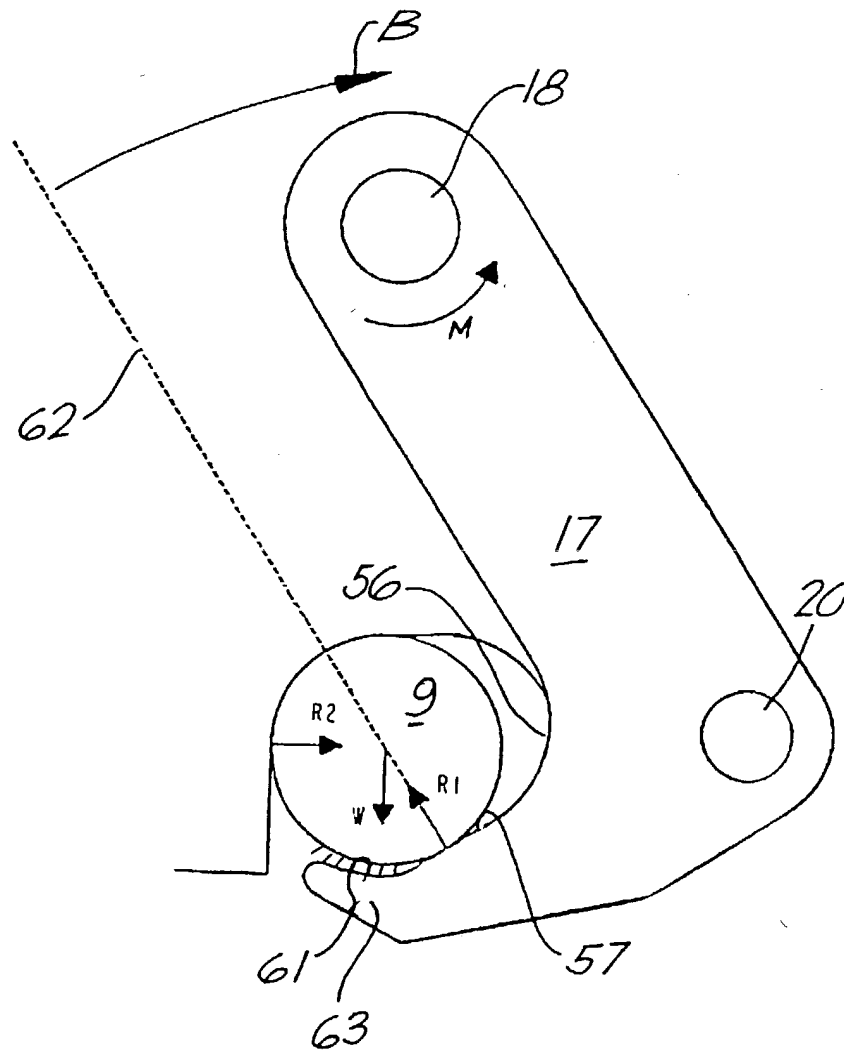


FIG. 9

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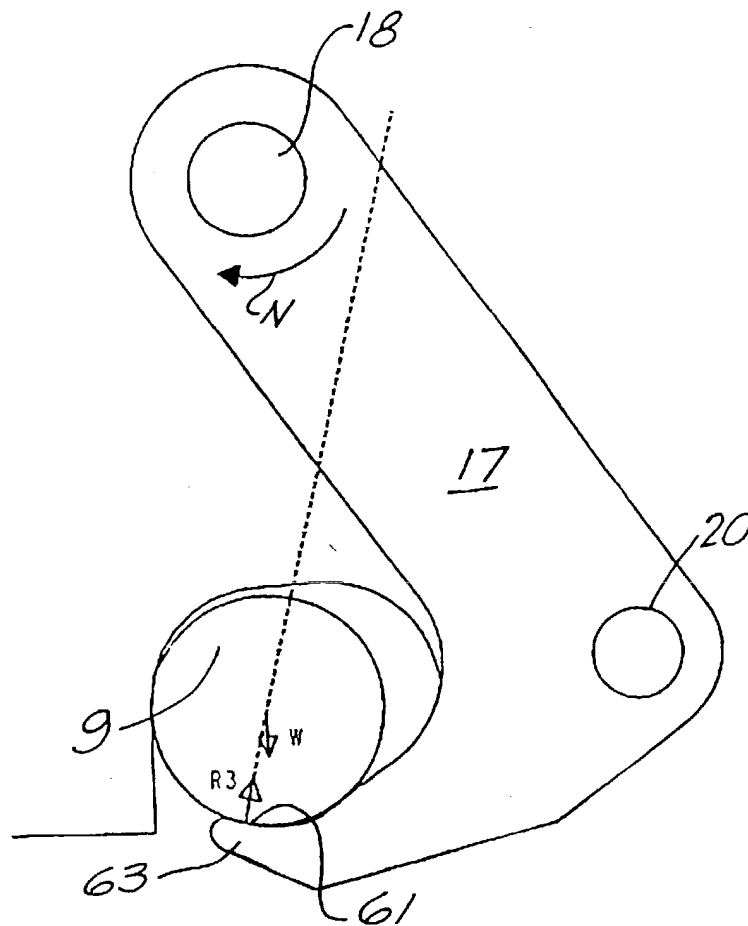
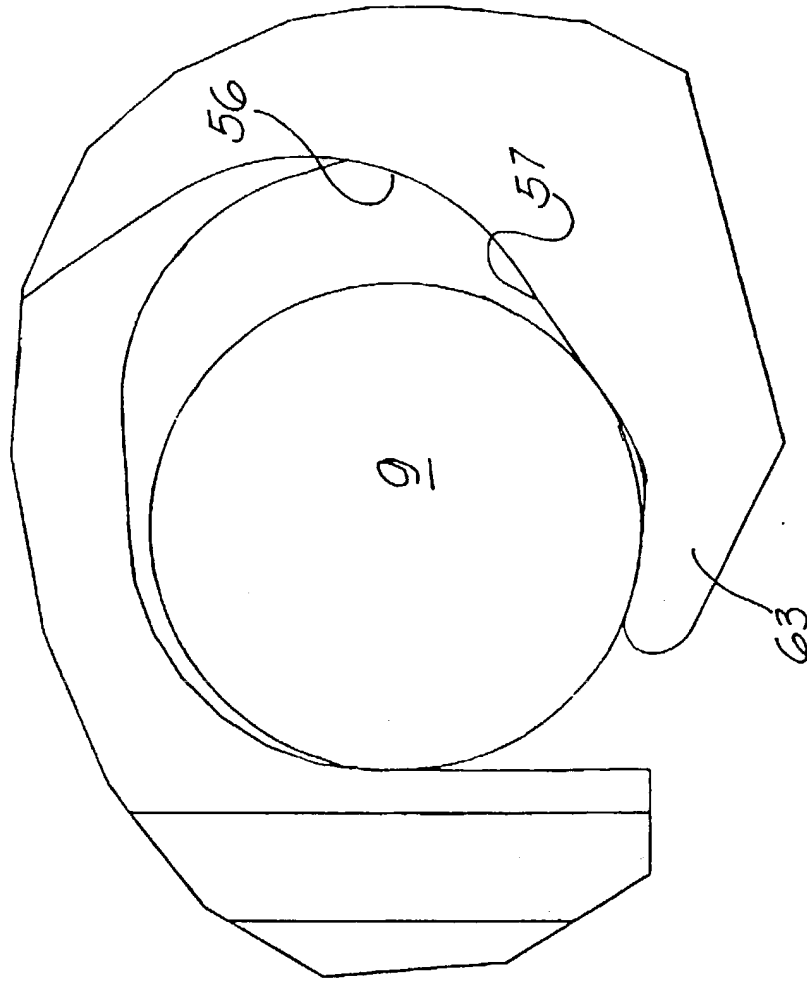


FIG. 10

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FIG. 11



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FIG. 12(3)

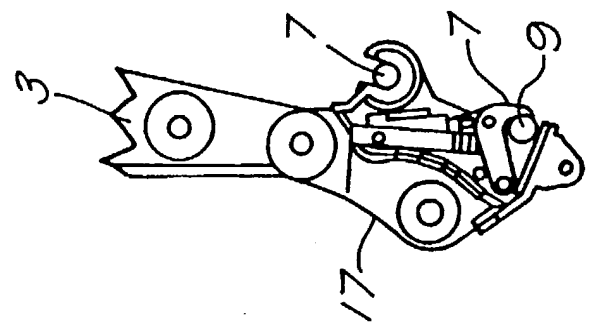


FIG. 12(2)

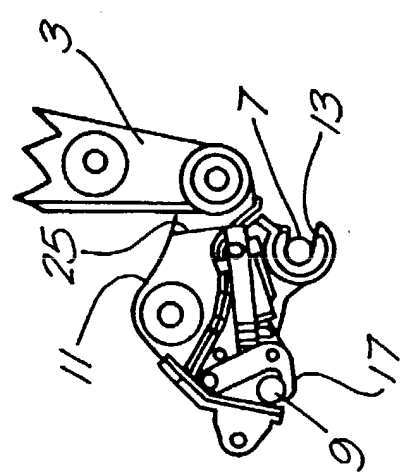


FIG. 12(1)

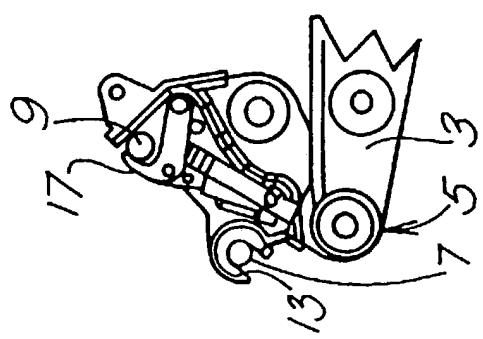


FIG. 12(6)

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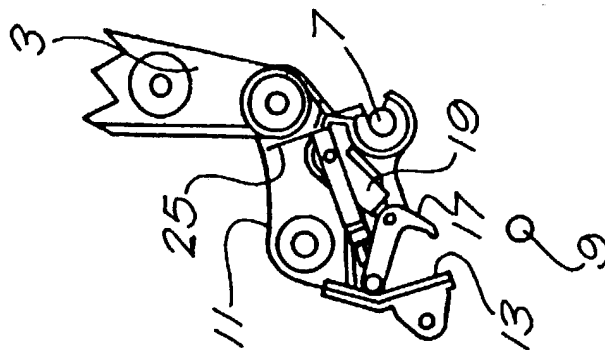


FIG. 12(5)

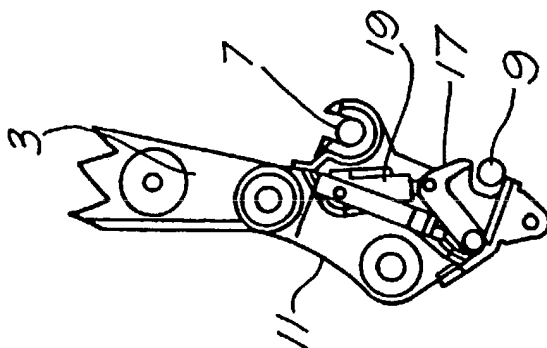
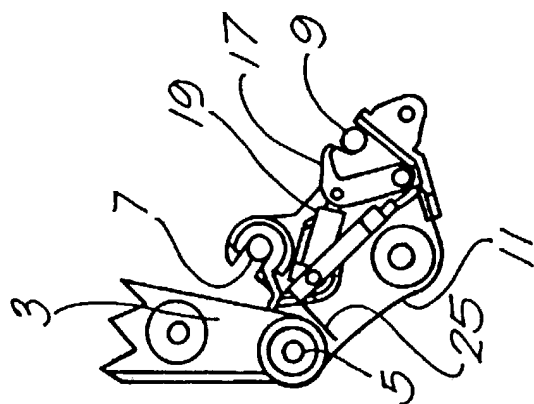
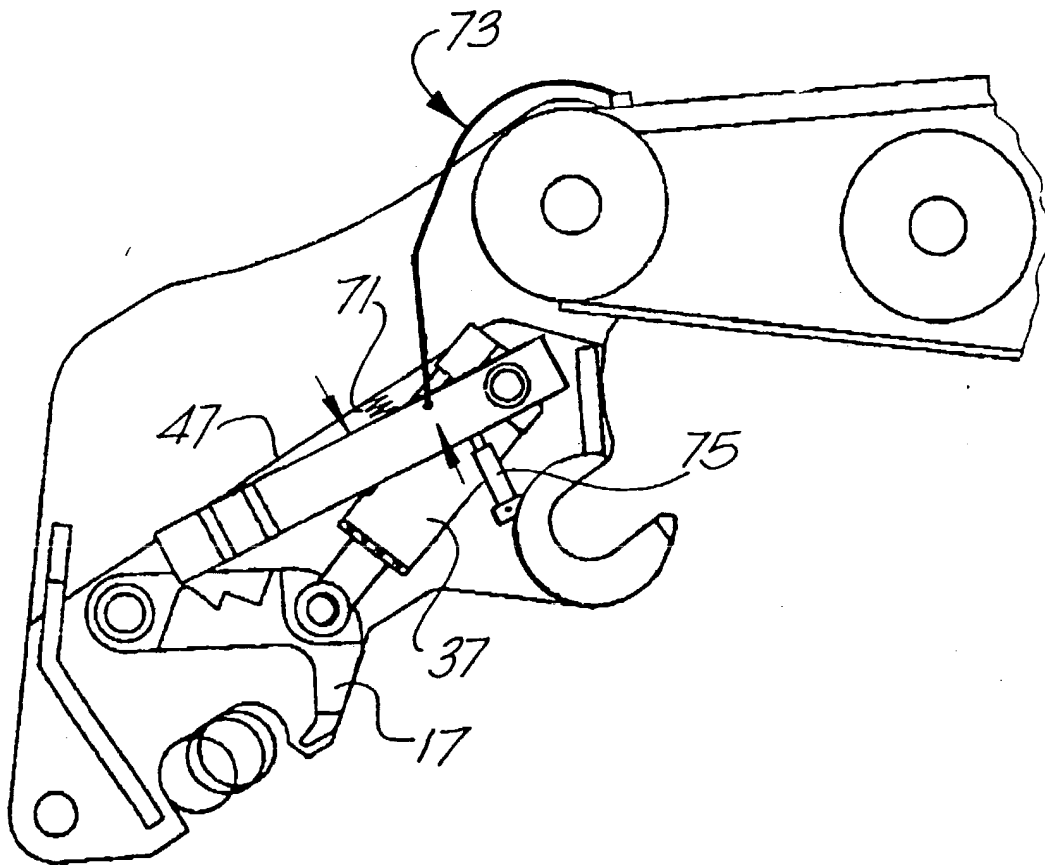


FIG. 12(4)



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FIG. 13



Quick Coupler for Bucket Excavators

This invention relates to a quick coupler for bucket excavators.

5 Hydraulically operated mechanical excavators have a dipper arm on the end of which
are two mounting points by means of which an excavating bucket is pivotally attached
to the end of the arm, and pivoted relative to the arm, respectively. Until relatively
recently, if the operator wished to change the bucket, e.g. to a larger one, this had to be
done manually. This involved the operator leaving the cab of the excavator, removing
10 two pivot pins by means of which the bucket is connected to the dipper arm, getting
back into the cab to lift the dipper arm clear of the bucket, aligning the dipper arm with
the new bucket (and aligning the pivot apertures), de-mounting from the cab again, and
locating the pivot pins in the aligned apertures, and securing them in place (e.g. with
circlips, locking pins or bolts or the like) and then getting back into the cab to use the
15 excavator. Sometimes, the operator would have considerable difficulty in removing or
re-inserting the pivot pins, due to slight misalignment of the pivot apertures, and would
have to use a heavy hammer for this purpose.

More recently, this time consuming exercise has been largely dispensed with, with the
20 introduction of quick couplers which are located between the dipper arm and the bucket.
The couplers can either be of the hydraulic type or of the mechanical type and are
effectively permanently fitted to the two pivot aperture of the dipper arm and the bucket
pivoting link, respectively. These couplers incorporate a generally horizontally and
rearwardly extending hook-like aperture or jaw adapted to engage with one of the pivot
25 pins on the bucket (both of which are left fitted to the bucket), and a generally
downwardly extending aperture or jaw adapted to locate over the other pivot pin on the
bucket, with which downwardly extending aperture a moveable latching hook is
associated.

30 In the manual version of the coupler, this latching hook is biased by a coil spring to its
latching position, and is moved away from its latching position by a release handle or
lever rod which is removably locatable in an aperture in the nose of the latching hook.

In the hydraulic version, a double acting hydraulic piston and cylinder device moves the latching hook between its respective positions, and check valves are located within the piston and cylinder device to prevent inadvertent movement of the piston in the event of hydraulic failure.

5

However, in both the manual and hydraulic versions, a safety pin has to be provided which must be located by the excavator operator in specially provided apertures in the coupler, to lock the latching hook in its latching position. This means that in both of these versions, the digger operator still has to leave his cab to secure in position the safety pin; this is inconvenient and time consuming.

10

It is an object of the present invention to provide a fully automatic coupler for an excavator bucket which can be operated by the excavator operator from his cab and be locked in its latching position without the operator having to leave the cab.

15

According to the present invention, we provide a coupler to enable an excavator operator to couple an excavator bucket to a dipper arm of an excavator without leaving his cab, the coupler being mountable upon or having means by means of which it can be coupled to the dipper arm of the excavator, a first hook-like aperture for engagement with a first pivot pin provided on an excavator bucket, a power operated latching hook operable by the operator from his cab for latching engagement with a second pivot pin provided on the bucket once the first hook-like aperture has been engaged with the first pivot pin, and locking means adjustably supported on the coupler and moveable from within the cab of the excavator from and into a locking position in which it prevents the latching hook from being disengaged from the second pivot pin on the bucket.

20

25

In one preferred construction, the locking means is moveable under its own weight by the force of gravity into a locking position in which it prevents the latching hook from being disengaged from the second pivot pin on the bucket, and resiliently deformable means is provided on the locking means which, in use, will engage an abutment when the coupler is inverted by rotation in one sense (with the result that the locking means will tend under its own weight to move away from its locking position) such

30

engagement resulting in the resiliently deformable means biasing the locking means into its locking position.

5 In this construction, by inverting the coupler, the locking means will move, under its own weight, to its unlocking position.

Alternatively, a spring may be provided permanently to bias the locking means into its locking position, and means is provided to move the locking means against the bias of the spring, to its unlocking position. In one arrangement, said means is provided by a
10 wire and pulley arrangement, the wire of which will tighten when the coupler is inverted, i.e. on full curl of the bucket, to move the locking means out of its locking position.

In an alternative construction, a small hydraulic cylinder could be provided to move the
15 locking means out of its locking position, against the bias of the spring.

Preferably, the latching hook is operated by means of a double acting piston and cylinder device, one end of which is pivotally connected about a first pivot axis to the coupler, and the other end of which is pivotally connected to the latching hook.
20

In one construction, the locking means comprises a bifurcated locking bar, the two limbs of which are pivotally supported on the coupler, preferably on the said first pivot axis, and the opposite end of which bears against a locking face on the rear of the latching hook.
25

In another construction, the locking means may comprise a single locking bar pivotally supported at one end region on the coupler, preferably on the first pivot axis and adapted to bear at its opposite end against a locking face on the rear of the hook.

30 Preferably, the locking face is stepped so that the coupler can be used with different sized bucket pivot pin distances (known as pin spread).

Preferably, the resiliently deformable means comprises an upstanding resiliently deformable arm on the locking bar which will bear against an abutment on the dipper arm when the coupler is inverted, e.g. when a bucket operating cylinder is retracted to pivot the bucket.

5

Preferably, a protection plate is fitted over the latching hook and locking means, through which plate the resiliently deformable arm projects, the plate being provided to ensure that excavated material does not interfere with the operation of the locking means. The plate may be welded or bolted in position. Hydraulic hoses for the double
10 acting piston and cylinder device for operating the latching hook may pass through one or more apertures in the plate, but it is preferred that the plate carries two hydraulic hose couplings and on the inner side of the plate, the couplings are permanently connected by suitable hoses to the said piston and cylinder device. This allows further hoses leading
15 to the coupler.

The spring for biasing the locking means into its locking position (if provided) may be located between the protection plate and the locking means.

20 Although the piston and cylinder device for the latching hook is provided with a check valve and the locking means is provided, it is important that maximum provision is made to ensure that a bucket cannot accidentally become disconnected from the coupler, and preferably therefore, the latching hook is designed so that it will not rotate to a release position when under load, or when there is a hydraulic failure in the piston and
25 cylinder device controlling the hook, and when the locking means has failed.

In the known coupler, the hook has a profile which is such that, under the above conditions, and the hook is carrying the weight of the bucket, the forces acting on the pin are such that there is a moment about the pivot supporting the hook which will
30 cause the hook to rotate to its unlatched position, thus releasing the bucket.

In the present invention, we preferably provide a hook which has a profile such that under the above conditions, and when the hook is carrying the weight of the bucket, and

there would otherwise be a tendency for the hook to rotate to a release position, the pin will move along the inner concave surface of the hook, thus causing the moment on the hook about its support pivot to move from a sense tending to cause the hook to swing to an open position, firstly so that there is no moment on the hook, and then to a sense so
5 that the moment tends to cause the hook to swing about the pivot towards a latching position.

For this purpose, the free end of the hook has an upturned, extended nose, the inner face of which is concave and which is preferably connected to the normal concave internal
10 surface of the hook by an internal planar portion.

Several preferred embodiments of coupler according to the present invention are now described by way of example with reference to the accompanying drawings, in which: -

15 FIGURES 1 to 3 are schematic side elevations showing how a coupler is used to connect an excavator bucket to a dipper arm of an excavator,

FIGURE 4 is a partly schematic side elevation with parts broken away, showing details of a manual prior art coupler,
20

FIGURE 5 is a view similar to Figure 4 of a hydraulically operated prior art coupler,

25 FIGURE 6 is a perspective view with parts broken away showing a first embodiment of coupler according to the invention,

FIGURE 7 is a view similar to Figure 6 showing a second embodiment of coupler according to the invention,
30

FIGURE 8 is a further perspective view with parts cut away showing two further preferred features of the invention,

FIGURE 9 is a scrap view showing a coupler latching hook according to a preferred feature of the invention,

FIGURE 10 is a view similar to Figure 9, but showing the hook with the
5 bucket pin in a slightly different position,

FIGURE 11 is an enlarged view showing the hook and pin in its Figure 10 position,

10 FIGURE 12 shows schematically six different relative orientations of an excavator dipper arm, coupler and excavator bucket, and

FIGURE 13 is a view similar to Figures 6-8, but showing the coupler in a different position, and showing two possible alternative constructions.

15

Referring to Figures 1 to 5 of the drawings, an excavator bucket is shown at 1, and the distal end of an excavator dipper arm is shown at 3. In accordance with standard practice, the dipper arm 3 supports a bucket piston and cylinder device 4 for controlling the bucket 1 via two pivot links 6, the bucket 1 normally being connected directly to the
20 dipper arm 3 by means of a first pivot pin 7 carried by the bucket and engaging directly within a mounting point or pivot aperture in an end region of the dipper arm 3 and a second pivot pin 9 engaging directly within a mounting point or pivot aperture 5' in an end region of one of the links 6 (this arrangement is not shown).

25 More recently, however, a coupler 11 has been used to enable the semi-automatic connection of the bucket 1 to the dipper arm 3 and as illustrated, the coupler has two mounting points thereon by means of which it is connected to the mounting points 5 and 5' on the dipper arm 3 and on the link 6 respectively, by suitable connecting pins 12. The coupler 11 is provided in a lower region thereof with a first generally horizontally
30 and rearwardly extending aperture or jaw 13 and a second generally downwardly extending aperture or jaw 15. By rearwardly extending, we mean opening outwardly, in use, from the coupler towards the operator of an excavator on which the dipper arm and coupler are fitted and by downwardly extending we mean, in use, extending or opening

outwards generally downwards towards the ground. In order to connect the bucket 1 to the dipper arm, the excavator operator manoeuvres the dipper arm to the position shown in Figure 1 and then moves the dipper arm downwardly and rearwardly so as to engage the first aperture or jaw 13 with the first pivot pin 7, which is virtually permanently fitted to the bucket 1; he then operates the bucket-controlling piston and cylinder device 4 so as to swing the pivot links 6 downwardly, as represented by the arrow A in Figure 2, so as to move the second aperture or jaw 15 into engagement with the second pivot pin 9, which is also virtually permanently secured to the bucket 1. The coupler is then latched in position so that the jaw 15 is clamped around the pin 9 and the bucket can be used for digging as illustrated in Figure 3.

In Figure 4, a manual prior art coupler is disclosed which is provided with a latching hook 17, pivotally supported on the body of the coupler about a pivot 18 and biased to a latching position (in which it maintains the pivot pin 9 in the aperture 15) by means of a coil spring 16. In order to move the hook 17 against the bias of the spring 16, e.g. to release the pivot pin 9 from the aperture 15 and thus to drop a bucket 1, a bar or release handle 14 has to be inserted into an aperture 10 in a nose portion of the hook 17 so that when downward pressure is applied to the end of the bar, the hook 17 will pivot about its pivot 18 accordingly.

20

In the hydraulic type of prior art coupler which is illustrated in Figure 5, the latching hook 17 is moved between its illustrated latching position and a release position by means of a double-acting hydraulic piston and cylinder device 19, the piston of which is pivotally connected to the hook at 20 and the cylinder of which is pivotally connected to the body of the coupler at 22. A suitable check valve (not shown) is provided within the piston and cylinder device 19 in case there should be a failure in the hydraulic supply to the piston and cylinder device 12. However, in case this check valve should fail, or in the case of the manual coupler shown in Figure 4, in case the spring 16 should fail, a safety pin 23 is always provided. This safety pin 23 bridges between the body or two side plates of the coupler 1 and a rear face of the latching hook 17 so as to hold the latching hook 17 in a latching position and prevent the bucket pivot 9 from being released from the aperture 15. The disadvantage with this arrangement is that every time the safety pin 23 has to be inserted or removed, the excavator operator has to

30

dismount from the cab of the excavator. This is time consuming and inconvenient for the excavator operator and as a result, the operator often never fits the safety pin 23.

In accordance with the present invention, automatically operating locking means is provided to overcome this problem. In the first embodiment of coupler as shown in Figure 6, wherein parts of the coupler have been broken away for the sake of clarity, the safety pin of the prior art construction shown in Figure 5 is dispensed with and replaced with a locking means shown generally at 25. The locking means is in the form of a bifurcated locking bar with two rearwardly extending limbs 26 which are pivotally supported on the pivot 22 by means of which the piston and cylinder device 19 is connected to the coupler 11, and a forward end 24 of which engages within a recess on a rear face of the latching hook 17. The locking means 25 moves into locking engagement with the roller of the latching hook 17 under its own weight due to the force of gravity, causing it to pivot anticlockwise about the pivotal connection 22 under normal operating conditions of the coupler and excavator bucket. However, in the event of the bucket operating piston and cylinder device 4 being retracted so as to lift the bucket so as to pivot it clockwise about the mounting point 5 on the dipper arm 3, there will be a tendency for the locking means 25 to become inoperative due to its own weight and accordingly, the locking means 25 is provided on its rearmost end with resiliently deformable means 27 which is then activated to bias the forward end 24 of the locking means into engagement with the rear face of the latching hook 17. This will hold the hook in its latching position to prevent inadvertent displacement of the second bucket pivot pin 9 from the aperture 15. In the preferred arrangement, the resiliently deformable means 27 is in the form of an upstanding leaf-spring 28, a free end portion of which will abut against an abutment on the dipper arm 3, thus producing a suitable reaction force to hold the locking means 25 in engagement with the rear face of the hook 17.

In the alternative embodiment shown in Figure 7, the bifurcated locking bar with its two limbs 26 is replaced by a single locking bar 37, which is pivotally connected to the pivot connection 22, as in the previous embodiment. Likewise, as in the previous embodiment, this single locking bar 37 has an upstanding leaf-spring 28 connected thereto which operates as previously described. In the embodiment of Figure 7, a

forward end portion 35 of the locking bar engages within a recess 33 in a rear face of the latching hook 17 to hold the latching hook 17 in its latching position but in other respects, the single locking bar 37 acts in the same way, under its own weight, as in the previous embodiment.

5

In a preferred arrangement of the embodiment shown in Figure 6, a series of steps or locking recesses 41 are provided on a rear face of the latching hook 17 with which a modified forward end portion 31 of the latching means engage. As will be apparent from Figure 8, the bucket pivot pin 9 shown therein is of a normal size, but by providing
10 the series of steps on the rear locking face of the latching hook 17, larger sizes of bucket pin 9, or different-sized bucket pin pivot centres (known as pin spread). can be accommodated.

From the foregoing, it will be appreciated that the gravity operated locking means 25
15 whether it be the embodiment shown in Figure 6 or the embodiment shown in Figure 7, or that shown in Figure 8, allows an excavator operator to change buckets without leaving his cab. This is because the latching hook 17 is hydraulically actuated by means of the piston and cylinder device 19, which itself is provided with check valves to prevent movement of the piston therein in the event of hydraulic failure. However,
20 even if there is a hydraulic failure and, the check valves also fail, then the locking means 25 will still prevent the latching hook 17 moving to an unlatched position.

When the excavator operator wishes to change a bucket, it is necessary for the operator fully to extend the piston and cylinder device 4 for the bucket to rotate the coupler
25 anticlockwise (as seen in the drawings) so as to move the bucket into a fully inverted position, wherein it is tucked beneath the dipper arm 3 (sometimes known as the crowd position) in which position the coupler 11 will be inverted and the locking means 25 will then swing under its own weight due to the forces of gravity to an unlatching position. This will then allow the operator to retract fully the piston of the piston and
30 cylinder device 19, thus moving the latching hook 17 to an unlatched position. When the bucket is in this position, its weight will be supported largely completely on the leading edge (or teeth if fitted) and the operator can then by retracting the main bucket operating piston and cylinder device 4, roll the coupler 11 to a generally vertical

position, thus allowing the second bucket pin 9 to swing out of the second aperture or jaw 15 (which is now generally rearwardly extending) whereupon, on further retraction of the piston and cylinder device 4, the coupler 11 will be moved back to its normal position, thus allowing the first pivot pin 7 to slide out of the rearwardly facing first aperture 13. This effectively disconnects the bucket from the coupler and allows the operator then to fit a different bucket to the dipper arm. These various different relative positions of dipper arm, coupler and excavator bucket are illustrated in the six different views comprising Figure 12 of the drawings.

- 10 Because of the provision of the gravity operated locking means 25, it is important to ensure that excavated material does not interfere with its satisfactory operation. Accordingly, we prefer to fit a protection plate 47 between the two side plates of the coupler 11, which completely overlies the locking means 25 and the double acting hydraulic piston and cylinder device 19, as shown in Figure 8. This plate 47 is
- 15 preferably welded in position and accordingly, has an aperture therein through which the resiliently deformable leaf-spring 28 projects. Furthermore, two hydraulic hose connectors are fitted to the plate, as shown at 55, to which hydraulic hoses 49 for the piston and cylinder device 19 are connected. On the upper exposed face of the plate 49, the connectors 55 are provided with fittings to receive connectors from further hydraulic
- 20 hoses (not shown), which are secured to the dipper arm 3 and lead to the main pressure system on the excavator. Although the presence of the protection plate 47 prevents the ingress of excavated material to the interior of the coupler, the provision of the hydraulic connectors 55 still allows the coupling 11 to be disconnected from the dipper arm if required and when various parts of the coupler become worn, these can all simply
- 25 be removed by dropping them downwardly from the coupler as shown in Figure 8, since all the various pivot connections are easily removable from the coupler.

In spite of the various safety features described above, all enabling bucket exchange to be carried out from the cab of the excavator, there is still a slight risk that the latching

30 hook 17 may swing to its unlatching position, thus allowing the bucket to be dropped from the dipper arm if there is a hydraulic failure, and the check valve in the piston and cylinder device 19 fail, and the gravity operated locking means 25 fails for some reason or another. Accordingly, we prefer to provide a modified latching hook which, under

normal conditions, cannot swing to an unlatched position, due to the weight of the bucket pivot 9 thereon. This modified latch hook is shown in Figures 9, 10 and 11.

Normally, with a latch hook such as shown in Figure 7 or Figures 4 and 5, the weight of the bucket on the hook, which is transferred to the hook through the bucket pin 9, will cause the hook to swing anticlockwise, due to the reaction force R1, acting on the inner concave face of the hook, causing an anticlockwise moment represented by the arrow M, shown in Figure 9. However, as is shown in Figure 9, the preferred hook of the invention instead of simply having an internal profile such as shown schematically in Figures 4 and 5, is provided not only with a first concave portion 56 and a planar portion 57, both of which are generally of known construction, but also with a second concave portion 61, by virtue of the presence of a nose portion 63 on the free end portion of the hook 17. As can be seen from Figure 9, when the bucket pin 9 is bearing down upon the first concave portion 56 of the hook, there will be reaction forces generated such that the moment acting on the hook 17 about its support pivot 18 is anticlockwise. However, as the coupler is tipped during operation, so that there is a tendency for the bucket 9 to move off the first concave surface 56 and onto the planar surface 57, reaction forces R1 and R2 will be generated, the two components of which, when combined, will eventually produce a composite force component which moves from the dotted line position 62, shown in Figure 9, in the direction of the arrow B. Eventually, as the pin 9 slides down the surface 57, the dotted line 62 will swing through the centre line of the pivot 18, whereupon there is no moment acting on the hook 17, about the pivot 18. Subsequently, the whole weight of the bucket pin 9 is supported on the second concave surface 61 on the interior of the nose portion 63 of the pin, whereupon the reaction force R2 disappears and the whole weight of the bucket is transferred to the bucket pin 92 to produce a reaction force R3, as shown in Figure 10, which will result in a clockwise moment acting on the latching hook 17 about its support pivot 18, as represented by the arrow N. When this occurs, which is at the time when the pin 19 would appear to be at a position in which it was thought it would cause the latching hook 17 to move to its unlatched position, the weight of the bucket on the latching hook 17 in fact causes the latching hook not to move to an unlatching position, but to tend to move clockwise about its support pivot 18 to its latching position. This effectively means that if none of the safety systems previously described is correctly

operating, it becomes impossible for the weight of the bucket to cause the latching hook to move to an unlatching position, because the shape of the internal surface of the newly provided tip portion 63 of the hook results in the moment N acting on the latching hook 17, always to move the latching hook 17 towards a latching position.

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With the construction shown in Figures 9, 10 and 11, it is only possible to disconnect a bucket from the coupler in the manner previously described and illustrated in the various views of Figure 12. In other words, it is necessary first fully to rotate the coupler 11 anticlockwise about its mounting point 5 on the end of the dipper arm 5, through the position shown in Figure 12 (3) to the fully tucked position shown in Figure 12 (4), when the weight of the bucket is fully supported on the ground. It is then possible, because there is no longer any weight whatsoever of the bucket carried by the latching hook 17, to activate the piston and cylinder device 19 to swing the latching hook 17 to a fully unlatched position, as shown in the position of Figure 12 (4). The bucket can then be unlatched, as previously described and as illustrated by the positions shown in Figures 12 (5) and 12(6).

It will, of course, be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention. For example, although the coupler is principally for coupling excavating buckets to the dipper arm, other attachments, such as concrete breakers, rippers and clamshells can be coupled to the dipper arm using the coupler, and the terms 'bucket' and 'buckets' should be interpreted accordingly. Furthermore, the coupler allows attachments from various different manufacturers in the same size excavator range to be used on a particular excavator.

Instead of the locking means i.e. the locking bar 26 or 37, being moveable under its own weight by the force of gravity into its locking position, and the resiliently deformable means 27 being provided to prevent the locking means moving out of its locking position when the coupler is inverted, by rotation in one sense about its mounting point 5, a spring 71 may be provided permanently to bias the locking means 37 into its locking position (see Figure 13). This spring 71 is a coil spring extending between the protection plate 47 and the locking means 37. In one arrangement, a wire and pulley

arrangement 73 is provided, the wire of which would tighten when the coupler is inverted, i.e. on full curl of the bucket, to move the locking means 37 out of its locking position.

- 5 In an alternative construction, a small hydraulic cylinder 75 could be provided to move the locking means 37 out of its locking position, and against the bias of the spring 37. Only then, could the piston and cylinder device 19 be operated to move the latching hook 17 to its bucket release position as shown in Figure 13.

CLAIMS

1. A coupler to enable an excavator operator to couple an excavator bucket to a dipper arm of an excavator without leaving his cab, the coupler being mountable upon
5 or having means by means of which it can be coupled to the dipper arm of the excavator, and comprising a first hook-like for engagement with a first pivot pin provided on an excavator bucket, a power operated latching hook adapted for operation by the operator from his cab for latching engagement with a second pivot pin provided on the bucket once the first hook-like aperture has been engaged with the first pivot pin,
10 and locking means adjustably supported on the body of the coupler and moveable from within the cab of the excavator from and into a locking position in which it prevents the latching hook from being disengaged from the second pivot pin on the bucket.
2. A coupler according to claim 1 wherein the latching hook is operated by means
15 of a double acting piston and cylinder device, one end of which is pivotally connected about a first pivot axis to the body of the coupler, and the other end of which is pivotally connected to the latching hook.
3. A coupler according to claim 2 wherein the locking means comprises a
20 bifurcated locking bar, the two limbs of which are pivotally supported on the first pivot axis, and the opposite end of which is adapted to bear against a locking face on the rear of the latching hook.
4. A coupler according to claim 2 wherein the locking means comprises a single
25 locking bar pivotally supported at one end region on the first pivot axis and adapted to bear at its opposite end against a locking face on the rear of the hook.
5. A coupler according to claim 3 or 4 wherein the locking face is stepped.
- 30 6. A coupler according to any one of claims 1-5 wherein the latching hook is designed so that it will not rotate to a release position when under load, or when there is a hydraulic failure in the piston and cylinder device controlling the hook, and when the locking means has failed.

7. A coupler according to claim 6 wherein the hook which has a profile such that under the above conditions, and when the hook is carrying the weight of the bucket, and there would otherwise be a tendency for the hook to rotate to a release position, the pin
5 will move along the inner concave surface of the hook, thus causing the moment on the hook about its support pivot to move from a sense tending to cause the hook to swing to an open position, firstly so that there is no moment on the hook, and then to a sense so that the moment tends to cause the hook to swing about the pivot towards a latching position.

10

8. A coupler according to claim 6 or 7 wherein the free end of the hook has an upturned, extended nose, the inner face of which is concave.

9. A coupler according to claim 8 wherein said concave inner face is connected to
15 the normal concave internal surface of the hook by an internal planar portion.

10. A coupler according to any one of claims 1-9 wherein a protection plate is fitted over the latching hook and locking means.

20 11. A coupler according to any one of claims 1-10 wherein the locking means is moveable under its own weight by the force of gravity into its locking position, in which it prevents the latching hook from being disengaged from the second pivot pin on the bracket, and wherein resiliently deformable means is provided on the locking means, which, in use, will engage an abutment when the coupler is inverted by rotation
25 in one sense (with the result that the locking means will tend under its own weight to move away from its locking position), such engagement resulting in the resiliently deformable means biasing the locking means into its locking position.

12. A coupler according to claims 10 and 11 wherein the resiliently deformable
30 means comprises an upstanding resiliently deformable arm on the locking bar which will bear against an abutment on the dipper arm when the coupler is inverted in use, the resiliently deformable means projecting through the plate which is provided to ensure that excavated material does not interfere with the operation of the locking means.

13. A coupler according to any one of claims 1-10 wherein a spring is provided permanently to bias the locking means into its locking position and means is provided to move the locking means, against the bias of the spring, to its unlocking position.

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14. A coupler according to claim 13 wherein said means is provided by a wire and pulley arrangement, the wire of which will tighten when the coupler is inverted, to move the locking means out of its locking position.

10 15. A coupler according to claim 13 wherein said means is provided by a hydraulic cylinder to move the locking means out of its locking position, against the bias of the spring.

16. A coupler according to claim 10 and any one of claims 11-15 wherein hydraulic
15 hoses for the double acting piston and cylinder device for operating the latching hook pass through one or more apertures in the plate.

17. A coupler according to claim 10 and any one of claims 11-16 wherein the plate
20 carries two hydraulic hose couplings and on the inner side of the plate, the couplings being permanently connected by suitable hoses to the said piston and cylinder device.

18. A coupler according to claim 17 wherein further hoses adapted to be connected
to the main pressure system on the excavator are connected to the coupler, using the hose couplings.

25

19. A coupler substantially as hereinbefore described with reference to Figures 6-12 of the accompanying drawings.

Amendments to the claims have been filed as follows

1. A coupler to enable an excavator operator to couple an excavator bucket to a dipper arm of an excavator without leaving his cab, the coupler comprising two spaced
5 side plates each having four fixed pin location points, the coupler being mountable in use between the bucket and the dipper arm and comprising a first aperture and a second aperture defining two of said points and connectable respectively, in use, to the dipper arm of the excavator and a bucket piston and cylinder device, by suitable pins, a first open-ended hook-like aperture defining a third of said points and for engagement with a
10 first pivot pin provided on an excavator bucket, and a pivoting latching hook co-operating with a second open-ended aperture defining said fourth point and for latching engagement with a second pivot pin provided on the bucket once the first hook-like aperture has been engaged with the first pivot pin, in use, power operated means for moving the latching hook between latching and unlatched positions and operable by the
15 operator from the cab, and blocking means adjustably supported on the body of the coupler and moveable from within the cab of the excavator from and into a blocking position in which it prevents the latching hook from being disengaged from the second pivot pin on the bucket.
- 20 2. A coupler according to claim 1 wherein the power operated means for controlling the latching hook is a double acting piston and cylinder device, one end of which is pivotally connected about a first pivot axis to the body of the coupler, and the other end of which is pivotally connected to the latching hook.
- 25 3. A coupler according to claim 2 wherein the blocking means comprises a bifurcated blocking bar, the two limbs of which are pivotally supported on the first pivot axis, and the opposite end of which is adapted to bear against a locking face on the rear of the latching hook.
- 30 4. A coupler according to claim 2 wherein the blocking means comprises a single blocking bar pivotally supported at one end region on the first pivot axis and adapted to bear at its opposite end against a face on the rear of the hook.

5. A coupler according to claim 3 or 4 wherein the face is stepped.
6. A coupler according to any one of claims 1-5 wherein the latching hook is designed so that it will not rotate to a release position when under load, or when there is
5 a hydraulic failure in the piston and cylinder device controlling the hook, and when the blocking means has failed.
7. A coupler according to claim 6 wherein the hook which has a profile such that under the above conditions, and when the hook is carrying the weight of the bucket, and
10 there would otherwise be a tendency for the hook to rotate to a release position, the pin will move along an internal concave surface of the hook, from a first position tending to unlatch the hook to one putting no unlatching force on and thereafter to one tending to move the hook to a latching position.
- 15 8. A coupler according to claim 6 or 7 wherein the free end of the hook has an upturned, extended nose, the inner face of which is concave.
9. A coupler according to claim 8 wherein said concave inner face is connected to the normal internal concave surface of the hook by an internal planar portion.
20
10. A coupler according to any one of claims 1-9 wherein a protection plate is fitted over the latching hook and blocking means.
11. A coupler according to any one of claims 1-10 wherein the blocking means is
25 moveable under its own weight by the force of gravity into its blocking position, in which it prevents the latching hook from being disengaged from the second pivot pin on the bucket, and wherein resiliently deformable means is provided on the blocking means, which, in use, will engage an abutment when the coupler is inverted by rotation in one sense (with the result that the blocking means would tend under its own weight to
30 move away from its blocking position), such engagement resulting in the resiliently deformable means biasing the blocking means into its latch locking position.

12. A coupler according to claims 10 and 11 wherein the resiliently deformable means comprises an upstanding resiliently deformable arm on the blocking bar which will bear against an abutment on the dipper arm when the coupler is inverted in use, the resiliently deformable means projecting through the plate which is provided to ensure
5 that excavated material does not interfere with the operation of the blocking means.

13. A coupler according to any one of claims 1-10 wherein a spring is provided permanently to bias the blocking means into its latch locking position and means is provided to move the blocking means, against the bias of the spring, to a position in
10 which it does not block the latching hook.

14. A coupler according to claim 13 wherein said means is provided by a wire and pulley arrangement, the wire of which will tighten when the coupler is inverted, to move the blocking means out of its latch locking position.

15

15. A coupler according to claim 13 wherein said means is provided by a hydraulic cylinder to move the blocking means out of its latch locking position, against the bias of the spring.

20 16. A coupler according to claim 10 and any one of claims 11-15 wherein hydraulic hoses for the double acting piston and cylinder device for operating the latching hook pass through one or more apertures in the plate.

17. A coupler according to claim 10 and any one of claims 11-16 wherein the plate
25 carries two hydraulic hose couplings and on the inner side of the plate, the couplings are permanently connected by suitable hoses to the said piston and cylinder device.

18. A coupler according to claim 17 wherein further hoses adapted to be connected to the main pressure system on the excavator are connected to the coupler, using the
30 hose couplings.

19. A coupler substantially as hereinbefore described with reference to Figures 6-8, 12 and 13 of the accompanying drawings.



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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.P): B8H (HPC).

Int CI (Ed.6): E02F 3/36.

Other: ONLINE : WPI, EDOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2,268,464 A (FERMEC). See Figs	1,2,10,13
X	GB 2,177,674 A (BAMFORD). See lines 110-118, page 3	1,2,10,13
X	EP 0,405,813 A2 (STEELFAB). See Figs 13-15	1,2,10,13
X	EP 0,184,282 A1 (JONES). See Figs	1,2,10,13
X	US 5,179,794 (BALLINGER). See Fig 7	1,2,10,13

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